



SERVICE MANUAL

BETHELEHEM CRUSADE-A-THERM

Manufactured By

DYNATHERM Boilers

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INSTALLING BETHLEHEM CRUSADE-A-THERM

INSTALLING JACKET

Remove the proper knockouts and place the top panel over the unit, put the side panels in place and slide the edges of the top panel down over the side panels; lock the panels together with bolts and nuts, and sheet metal screws provided for that purpose; close the two ends by putting the respective door panels in place.

PIPING TO BOILER

Connect the riser and return piping to the Crusade-A-Therm. The riser should be run a vertical distance of at least 12" above the boiler outlet. The return must be run horizontally and at right angles to the centerline of the boiler for a distance of at least 13" so as to clear the side panel of the jacket.

FUEL LINES TO BURNER

Connect the suction line from the oil storage tank to the pump using an unbroken length of copper tubing and flare type fittings. The suction line should pass within the jacket immediately below and through the same opening as the return piping or through one of the openings provided in side panels. If an outside storage tank is used, a return line to the tank must be provided.

ELECTRICAL WIRING

All auxiliary electrical equipment and wiring are to be installed by an experienced electrician in accordance with the National Electrical Code and with Local Ordinances. Wiring is to be done in BX cable or conduit.

All connections must be soldered or approved connectors used. Minimum conductor size should be #14. See rear of Manual for electrical wiring diagrams.

The thermostat is to be installed preferably on the main floor in one of the normally occupied rooms, the living room being a desirable location in most instances.

Locate the thermostat not more than five feet above the floor in a position where it will be least affected by draft, radiation, the cooling affect of a window or an outside wall. When in thermostat leads are brought through a hole made in the wall, the space around the leads should be packed with asbestos wool. Connect the power service line from a switch on the wall to the two wires in the junction box marked "H", for hot and "G" for ground. This service line should pass within the jacket immediately below and through the same opening as the return piping or through one of the openings provided in the side panels. When the Crusade-A-Therm is used in connection with steam, vapor, or gravity -- hot water systems, connect the thermostat in the low voltage terminals in the combustion control.

FLUE GAS OUTLET

Connect the flue gas outlet of the Crusade-A-Therm with the chimney using 6" dia. Galvanized stove pipe. The chimney should not be smaller than 8" round or square.

DOMESTIC HOT WATER

Make connections to the hot water coil and provide valves for back flushing the coil.

WATER SUPPLY TO BOILER

Connect water supply to return piping of the unit. Fill boiler and system with water and check for leaks.

FUEL SUPPLY TO BURNER

The Bethlehem Crusade-A-Therm is listed by the Underwriters to burn #2 Commercial Standard grade fuel oil. Since the grades marketed by different oil distributors vary, it is advantageous for you to be familiar with the quality of fuels available in your territory.

STARTING BETHLEHEM CRUSADE-A-THERM

Before starting burner:

1. Check electrical connections.
2. Check oil connections to tank and pump.
3. See that the electrodes are properly positioned. The electrodes should be 3/8" above the center of the nozzle tip, and 1/16" forward of the face of the nozzle tip. The gap should be 3/16" wide. See that the electrodes are spaced 1/4" from any grounded metal. The face of the nozzle tip should be 1/4" behind the orifice plate in the nosepiece.
4. Oil Motor: The motors have sleeve bearings and are wick oiled. Fill the reservoir with high-grade spindle oil that will flow at low temperatures.
5. See that the proper fuel oil is in the tank. (The Bethlehem Crusade-A-Therm has been approved to burn not heavier than Commercial Standard #2 Fuel Oil.)
6. Be sure that the combustion control is in the starting position.
7. See that all joints of smoke pipe are tightly made up and sealed to the chimney.
8. See that the system is fully supplied with water as required.
9. Set room thermostat at a point slightly above room temperature.
10. See that the boiler control is in the "ON" position.
11. Open valve in fuel oil line.
12. Gravity Feed Installations:

To vent the fuel unit on a single pipe system, remove the plug located in the side of the regulating valve chamber.

With the fuel unit in operation, allow enough oil to drain out to purge the entire system of air. Catch the overflow in a suitable container. This same tapping is for use of the pressure gauge when setting the Crusade-A-Therm for 11% CO₂.

Sub-Gravity Installations:

These must have a return line from the fuel unit to the storage tank. In all other respects, the starting instructions are the same as for gravity feed installations.

ADJUSTING BETHLEHEM CRUSADE-A-THERM

COMBUSTION EFFICIENCY OIL PRESSURE, ETC.

The Bethlehem Crusade-A-Therm by virtue of its construction is distinctive in its operation. Positive pressure is generated throughout the combustion zone thus eliminating the necessity for ideal draft conditions -- the so-called "chimney pull" -- that most conventional types of burners depend upon. It is designed to operate at its maximum efficiency when producing its rated output with 11% CO₂ in the combustion gas, and any other setting will result in increased stack temperature and lowered efficiency.

For this reason it is not possible to adjust the burner by observing the color or character of the flame. THE FLUE GASES MUST BE ANALYZED AND THE CO₂ CONTENT CHECKED. TO DO THIS PROCEED AS FOLLOWS:

Allow the burner to operate for about 10 minutes, then remove the pipe plug from the smoke pipe elbow at the upper rear of the unit. Insert the sampling tube of an Orsat and pump a representative sample of flue gas into the Orsat.

These for the CO₂ content. If analysis shows more or less than 11% CO₂, either increase or decrease the oil pressure until the correct treading is obtained. Increasing the oil pressure increase the CO₂ content; decreasing the oil pressure decreases the CO₂ content. The oil pressure can be varied by removing the cover over the adjusting screw and turning this screw. To increase oil pressure, turn screw clockwise and to decrease oil pressure, turn screw counter-clockwise. Be sure to replace cover and gasket when adjustment is completed. When 11% CO₂ is obtained, the oil pressure should be in the range of 80 lbs. to 125 lbs. If oil pressure is below 80 lbs. when 11% CO₂ is obtained, install the next smaller size nozzle. If above 125 lbs. when 11% CO₂ is obtained, install the next larger size nozzle and again adjust the oil pressure for 11% CO₂.

USE A PRESSURE GAUGE WHEN INCREASING OR DECREASING OIL PRESSURE.

NOZZLES

It is very important that the proper nozzle size and spray angle be used with the Bethlehem Crusade-A-Therm.

The following sizes and spray angles must be used:

#36 1.00/30 deg. or 1.25/30 deg. Hollow

If other than 30 degree nozzles are used, the result will be carbon deposits in the nose piece and combustion tube, which will cause unsatisfactory operation and safety shut down.

CONTROLS

Carefully check the operation of all controls and make sure that they function properly.

IF THE OPERATION IS NOT NORMAL, CHECK THE FOLLOWING:

1. If the motor does not start, trip the safety switch button on the combustion control. If this fails to produce the desired result, follow the instructions in the control instruction pages.
2. If motor starts and "safety shut down" continues, the oil systems should be rechecked for leaks or air traps. Check the fuel unit; if it is air-bound, remove pipe plug and allow air to escape, and then replace pipe plug when oil

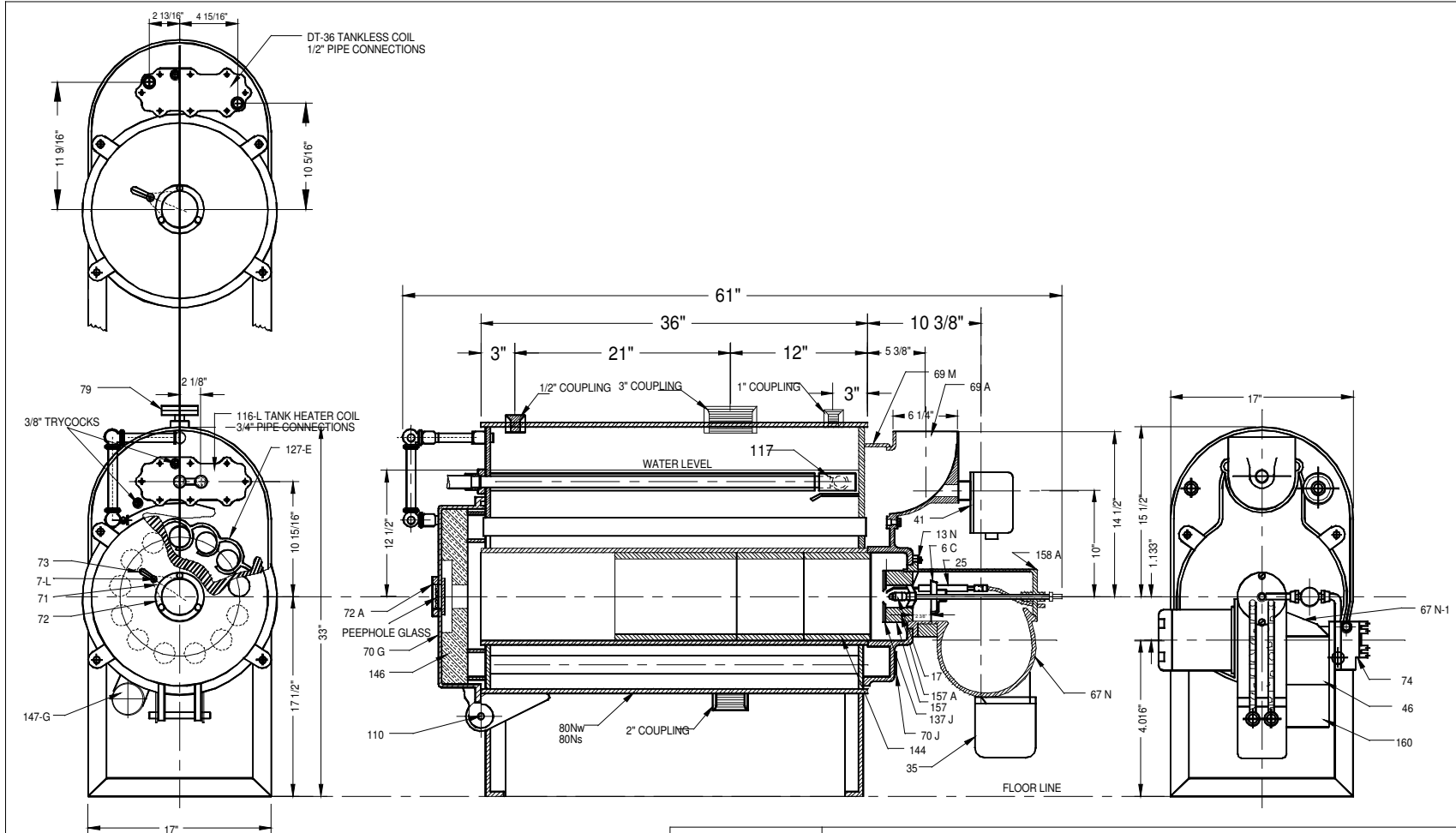
CRUSADE-A-THERM RATINGS AND DATA

BOILER NUMBER 36		
Steam)	sq. ft.	350
Vapor)- Net Rating*	sq. ft.	375
Hot Water)	sq. ft.	560
Boiler Output BTU per hr.)_ Gross	1000's	120
Boiler Output-Kilogram-Calorie) Rating**	1000's	30
Nozzle Size Nominal	gal/hr	1.00
Firing Rate	gal/hr	1.12
Chimney Size	in	8x8
Boiler Outlet Size	in	3
Boiler Return Size	in	2
Safety Valve Size	in	1
Crate -- width	in	20 1/2
-- length	in	62
-- height	in	36
Shipping weight -- crated	lbs	775
Shipping weight of Jacket	lbs	150

* NET RATING = Actual Standing Radiation with piping, pick up, and domestic hot water allowances already made

** GROSS RATING = Actual boiler Output which is 30% greater than Net Rating.

<div>DYNATHERM</div>		BILL OF MATERIALS		<div><div>WHIRLING FLAME</div></div>		DWG G-367	
		BETHLEHEM CRUSADE-A-THERM				SHEET	REVISED
						1	
NO.	SPARE PARTS CODE	DESCRIPTION	NO.	SPARE PARTS CODE	DESCRIPTION		
6 C	919.100	Electrode Bracket	74		Fuel Unit		
7 L		Knurled Pin	79		Temperature Pressure Gauge		
13 N		Oil Pipe Spider	80 Ns		Boiler Body - Steam		
15-5		Motor	80 Nw		Boiler Body - Water		
17	511.000	Nozzle	110		Hinge Pin		
25		Electrode	116 L		Tank Heater Coil		
35		Transformer	117		Return Ell		
41		ProtectoRelay	127 E	210.000	Scroll		
46		Junction Box Cover	137 J	207.003	Orifice Plate		
67 N		Housing	144	503.006	Liners		
67 N-1		Coupling Cover	146	921.001	Refractory Insert		
69 A		Elbow	147 G		Air Silencer		
69 M	200.103	Flue Connection	157		Nose Piece		
70 G		Clean Out Cover	157 A		Sleeve		
70 J		Clean Out Cover	158 A		Nozzle Plate		
71		Peephole Slide	160		Delay Relay		
72	202.102	Peephole Cover	DT 36		Tankless Heater Coil		
72 A		Peephole Gasket					
73	102.316	Peephole Lever					
	100.317	Peephole Glass					



<p>DYNATHERM 43 E CHERRY RD, QUAKERTOWN, PA 18951</p>		
<p>FRACTIONAL + -</p>	<p>BETHLEHEM CRUSADE-A-THERM</p>	
	<p>SCALE</p>	<p>DRAWN BY</p>
<p>ANGULAR + -</p>	<p>DATE</p>	<p>APPROVED BY</p>
<p>TITLE</p>		
<p>CT-36 GENERAL ARRANGMENT</p>		
<p>2/27/50</p>		<p>DRAWING NUMBER</p>
<p>G-367</p>		